Results of In-Mine Slug Tests on the Star Point Sandstone, Genwal Resources, Crandall Canyon Mine

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Genwal Resources, Inc., Huntington, Utah

07 November 1997

Mayo and Associates, LC
Consultants in Hydrogeology

0075

ENERGY WEST Mining Co.
PO Box 310
Huntington, Utah 84528

COPY

November 23, 2002

OK

Mr. Jim Smith
Utah Coal Program
Utah Division of Oil, Gas, and Mining
1594 West North Temple, Suite 1210
P.O. Box 145801
Salt Lake City, Utah 84114-5801

Incoming
C/015/018
Copy Jim Smith (all)

Subj: Mill Fork Hydrologic Review - Data Request: Results of In-Mine Slug Test on the Star Point Sandstone, Genwal Resources, Crandall Canyon Mine, Mill Fork Lease, PacifiCorp, Deer Creek Mine, C/015/018-PM01I.

On page 36 of the Mill Fork Lease Technical Analysis dated October 9, 2002 (C/015/018-PM01I-1), the Division states that, "hydrologic and geologic information for the cumulative impact area have been obtained by the Division from federal or state agencies. Additional information has been included with the PAP". The Division provides a list of the obtained documents on pages 36 and 37, and states that it has copies of all reports except for #3 - Results of In-Mine Slug Test on the Star Point Sandstone. This report was cited by Mayo & Associates in Volume 12: R645-301-700: Appendix B, page 132. Enclosed is a copy of the Mayo and Associates report entitled, "Results of In-Mine Slug Test on the Star Point Sandstone, Genwal Resources, Crandall Canyon Mine". This information was obtained from Genwal Resources. A representative from Genwal indicated this report is included as part of their current MRP.

If there are any questions with this request submittal, please call me at (435) 687-4720.

Sincerely,

Charles A. Semborski
Geology/Permitting Supervisor

cc: Carl Pollastro (EWMC)
File

File in:
C/015/018, 2002, Incoming
Refer to:
☐ Confidential
☐ Shelf
☒ Expandable
Date 11/23/02 for additional information

RECEIVED
NOV 27 2002
DIV. OF OIL, GAS & MINING

J:\Environmental\Mill Fork Lease\Mill Fork Permit\SlugTestDataSubmittal_DOGM.wpd

Huntington Office:
(801) 687-9821
Fax (801) 687-2695
Purchasing Fax (801) 687-9092

Deer Creek Mine:
(801) 381-2317
Fax (801) 381-2285

Cottonwood Mine:
(801) 748-2319
Fax (801) 748-2380

Results of In-Mine Slug Tests On the Star Point Sandstone

Genwal Resources Crandall Canyon Mine

Conducted August and September, 1997

7 November 1997

Introduction

During August and September 1997, Mayo and Associates personnel conducted slug and recovery tests on four monitoring wells in the Crandall Canyon Mine. The wells tested included MW-2, MW-7, and MW-6a completed in the Spring Canyon member of the Star Point Sandstone and Well MW-6 completed in the Panther member of the Star Point Sandstone. The locations of these wells are shown on Figure 1.

Methodology

Each of the wells tested, with the exception of MW-2, were constructed in early 1997. The wells were cased with 1.25" I.D. PVC pipe. The screened intervals were packed with silica sand. The annulus of each well was plugged with Bentonite and back-filled to the surface with concrete. Well MW-2 was constructed at an earlier time and is not cased. Well logs for these wells are included as an attachment to this report.

The tests on wells MW-2, MW-6a, and MW-6 were performed by rapidly removing a volume of water from the well casing. A slug of water was rapidly removed from wells MW-2 and MW-6a using a nitrogen gas driven air lift system. Water from well MW-6 was removed by rapidly removing a long plastic bailer. Well test recoveries were logged using automated electronic pressure transducers and data loggers obtained from In-Situ Incorporated of Laramie, Wyoming. The hydraulic head at well MW-7 is above ground surface and a shut-in recovery test was required. Well recovery measurements were made on this well using a pressure gage and a stop watch. The time-recovery data for each of the slug tests are included as an attachment to this report.

The time-recovery data for each well were plotted electronically. Values of hydraulic conductivity were calculated for each well using both computer methods and conventional manual calculations. The results of the slug tests are given in Table 1 below.

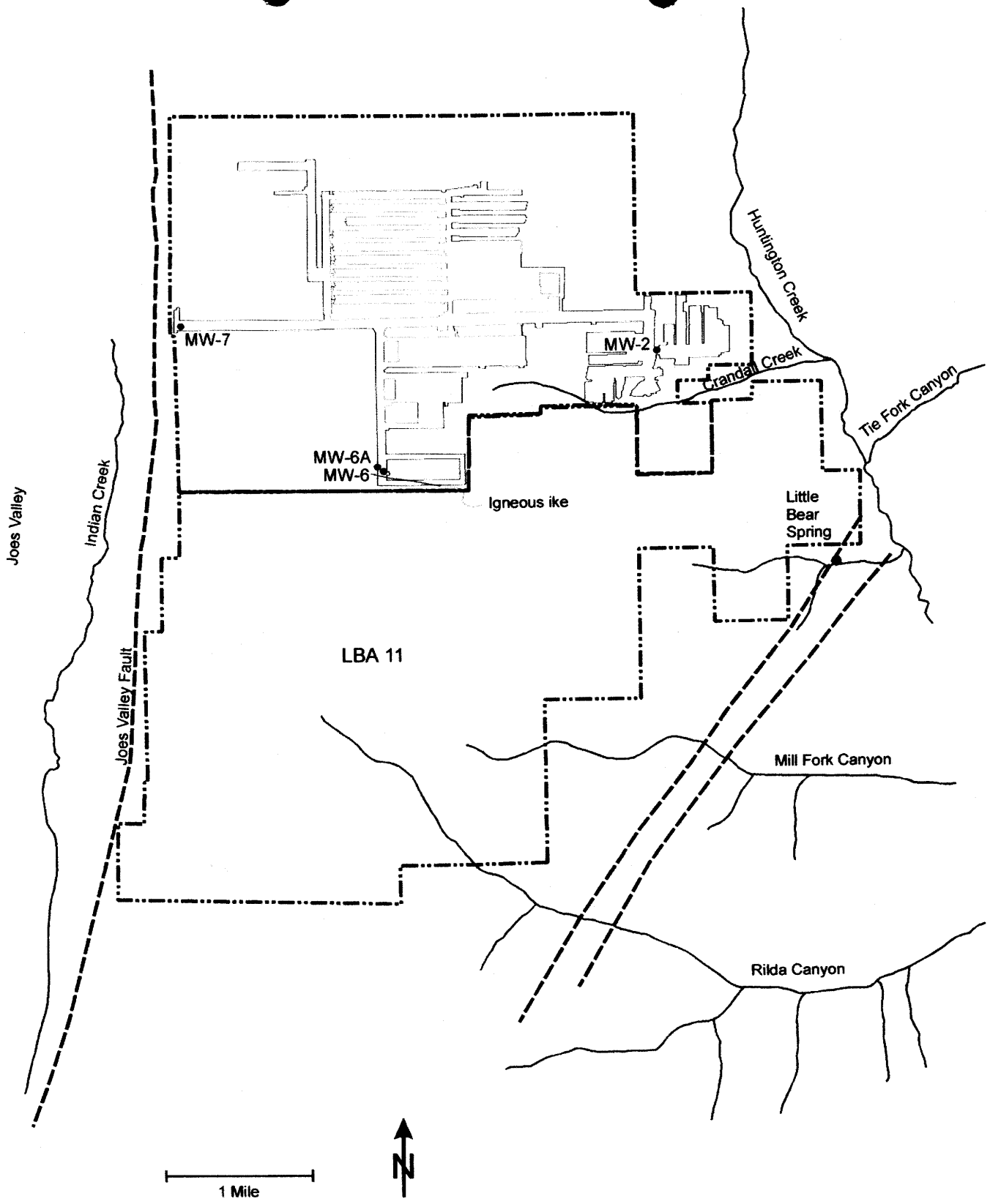


Figure 1 Map showing location of wells slug tested in the Crandall Canyon Mine.

Table 1 Slug test results

Well	Formation	Type of test	Hydraulic Conductivity (feet/second)
MW-2	Spring Canyon	Slug recovery	4.8×10^{-8} to 4.9×10^{-8}
MW-6A	Spring Canyon	Slug recovery	4.4×10^{-8} to 5.9×10^{-8}
MW-7	Spring Canyon	Shut-in recovery	7.4×10^{-8}
MW-6	Panther	Slug recovery	6.2×10^{-8} to 7.4×10^{-8}

Interpretation

The values of hydraulic conductivity calculated for the Star Point Sandstone are low. These values are consistent with the antiquity of the groundwater contained in the sandstone.

MW-2 slug test

Time (minutes)	Depth to water
56.4	11.651
58.4	11.604
60.4	11.556
62.4	11.509
64.4	11.477
66.4	11.429
68.4	11.382
70.4	11.334
72.4	11.287
74.4	11.255
76.4	11.207
78.4	11.16
80.4	11.112
82.4	11.081
84.4	11.033
86.4	10.986
88.4	10.954
90.4	10.906
92.4	10.843
94.4	10.827
114.4	10.383
134.4	10.003
154.4	9.623
174.4	9.242
194.4	8.893
214.4	8.561
234.4	8.275
254.4	7.974
274.4	7.705
294.4	7.467
314.4	7.198
334.4	6.96
354.4	6.738
374.4	6.516
394.4	6.31
414.4	6.088
434.4	5.898
454.4	5.708
474.4	5.533
494.4	5.327
514.4	5.153
534.4	4.995
554.4	4.852
574.4	4.662
594.4	4.535
614.4	4.392
634.4	4.234
654.4	4.107

MW-2 slug test

Time (minutes)	Depth to water
674.4	3.948
694.4	3.853
714.4	3.711
734.4	3.584
754.4	3.489
774.4	3.346
794.4	3.235
814.4	3.14
834.4	3.061
854.4	2.95
874.4	2.855
894.4	2.775
914.4	2.664
934.4	2.601
954.4	2.49
974.4	2.427
994.4	2.348

MW-2 slug test

Time (minutes)	Depth to water
0	13.109
0.2	13.093
0.4	13.093
0.6	13.078
0.8	13.062
1	13.062
1.2	13.062
1.4	13.046
1.6	13.062
1.8	13.03
2	13.03
2.2	13.014
2.4	13.014
2.6	12.998
2.8	12.998
3	12.998
3.2	12.982
3.4	12.982
3.6	12.967
3.8	12.967
4	12.967
4.2	12.951
4.4	12.951
6.4	12.903
8.4	12.856
10.4	12.792
12.4	12.745
14.4	12.681
16.4	12.618
18.4	12.57
20.4	12.523
22.4	12.475
24.4	12.428
26.4	12.364
28.4	12.317
30.4	12.269
32.4	12.222
34.4	12.174
36.4	12.127
38.4	12.079
40.4	12.047
42.4	11.984
44.4	11.936
46.4	11.905
48.4	11.841
50.4	11.81
52.4	11.746
54.4	11.699

MW-6 slug test

Time (minutes)	Depth to water
0	6.02
0.2	5.973
0.4	5.926
0.6	5.895
0.8	5.847
1	5.832
1.2	5.8
1.4	5.785
1.6	5.769
1.8	5.737
2	5.706
2.2	5.69
2.4	5.659
2.6	5.643
2.8	5.612
3	5.596
3.2	5.565
3.4	5.549
3.6	5.533
3.8	5.502
4	5.486
4.2	5.47
4.4	5.439
4.6	5.423
4.8	5.392
5	5.376
5.2	5.36
5.4	5.345
5.6	5.313
5.8	5.298
6	5.266
6.2	5.25
6.4	5.235
6.6	5.203
6.8	5.188
7	5.172
7.2	5.156
7.4	5.14
7.6	5.109
7.8	5.093
8	5.077
8.2	5.062
8.4	5.03
8.6	5.015
8.8	4.999
10.8	4.81
12.8	4.637
14.8	4.464

MW-6 slug test

Time (minutes)	Depth to water
16.8	4.292
18.8	4.135
20.8	3.977
22.8	3.836
24.8	3.71
26.8	3.569
28.8	3.443
30.8	3.317
32.8	3.207
34.8	3.082
36.8	2.956
38.8	2.877
40.8	2.783
42.8	2.688
44.8	2.579
46.8	2.5
48.8	2.406
50.8	2.327
52.8	2.249
54.8	2.186
56.8	2.107
58.8	2.029
60.8	1.966
62.8	1.903
64.8	1.856
66.8	1.777
68.8	1.73
70.8	1.667
72.8	1.636
74.8	1.589
76.8	1.526
78.8	1.494
80.8	1.432
82.8	1.4
84.8	1.368
86.8	1.321
88.8	1.29
90.8	1.243
92.8	1.211
94.8	1.18
96.8	1.164
98.8	1.133
118.8	0.897
138.8	0.724
158.8	0.63
178.8	0.551

MW-6A slug test

Time (minutes)	Depth to water
0	67.575
0	68.534
0	68.581
0	67.921
0.1	66.962
0.1	66.443
0.1	65.798
0.1	65.39
0.1	64.525
0.2	64.478
0.2	64.226
0.2	63.754
0.2	63.298
0.2	63.361
0.2	63.377
0.3	63.267
0.3	63.125
0.3	62.999
0.3	62.78
0.3	62.544
0.3	62.229
0.4	61.93
0.4	61.632
0.4	61.38
0.6	58.911
0.8	57.59
1	56.615
1.2	55.845
1.4	55.231
1.6	54.728
1.8	54.304
2	53.942
2.2	53.628
2.4	53.345
2.6	53.109
2.8	52.889
3	52.684
3.2	52.511
3.4	52.338
3.6	52.165
3.8	52.008
4	51.851
4.2	51.709
4.4	51.568
4.6	51.426
4.8	51.285
5	51.143
5.2	51.017

MW-6A slug test

Time (minutes)	Depth to water
5.4	50.891
5.6	50.766
5.8	50.64
6	50.514
6.2	50.388
6.4	50.262
6.6	50.152
6.8	50.026
7	49.916
7.2	49.791
7.4	49.681
7.6	49.555
7.8	49.445
8	49.319
8.2	49.209
8.4	49.083
8.6	48.973
8.8	48.847
9	48.737
9.2	48.627
9.4	48.501
11.4	47.416
13.4	46.394
15.4	45.387
17.4	44.412
19.4	43.453
21.4	42.525
23.4	41.613
25.4	40.716
27.4	39.835
29.4	38.986
31.4	38.137
33.4	37.319
35.4	36.517
37.4	35.715
39.4	34.944
41.4	34.189
43.4	33.45
45.4	32.726
47.4	32.019
49.4	31.327
51.4	30.635
53.4	29.974
55.4	29.329
57.4	28.7
59.4	28.071
61.4	27.473
63.4	26.875

MW-6A slug test

Time (minutes)	Depth to water
65.4	26.293
67.4	25.726
69.4	25.177
71.4	24.626
73.4	24.106
75.4	23.588
77.4	23.084
79.4	22.597
81.4	22.109
83.4	21.637
85.4	21.181
87.4	20.724
89.4	20.284
91.4	19.86
93.4	19.435
95.4	19.01
97.4	18.617
99.4	18.224
119.4	14.731
139.4	11.742
159.4	9.382
179.4	7.557
199.4	6.125
219.4	4.993
239.4	4.096
259.4	3.372
279.4	2.774
299.4	2.286
319.4	1.893
339.4	1.562
359.4	1.279
379.4	1.059
399.4	0.886
419.4	0.729
439.4	0.603
459.4	0.509
479.4	0.414
499.4	0.351
519.4	0.304
539.4	0.257
559.4	0.226
579.4	0.194
599.4	0.178
619.4	0.162
639.4	0.131
659.4	0.131
679.4	0.131
699.4	0.115

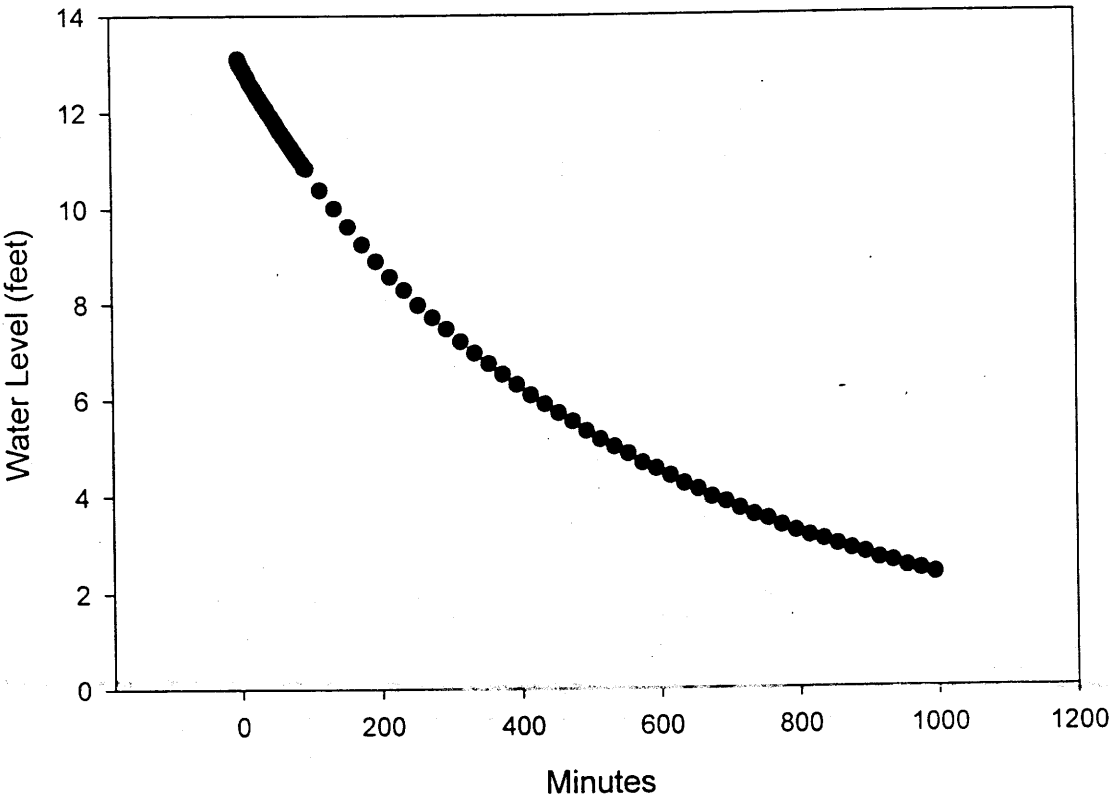
MW-6A slug test

Time (minutes)	Depth to water
719.4	0.115
739.4	0.115
759.4	0.099
779.4	0.099
799.4	0.099
819.4	0.099
839.4	0.099
859.4	0.099
879.4	0.099
899.4	0.099
919.4	0.099
939.4	0.099
959.4	0.084
979.4	0.084
999.4	0.084
1199.4	0.052

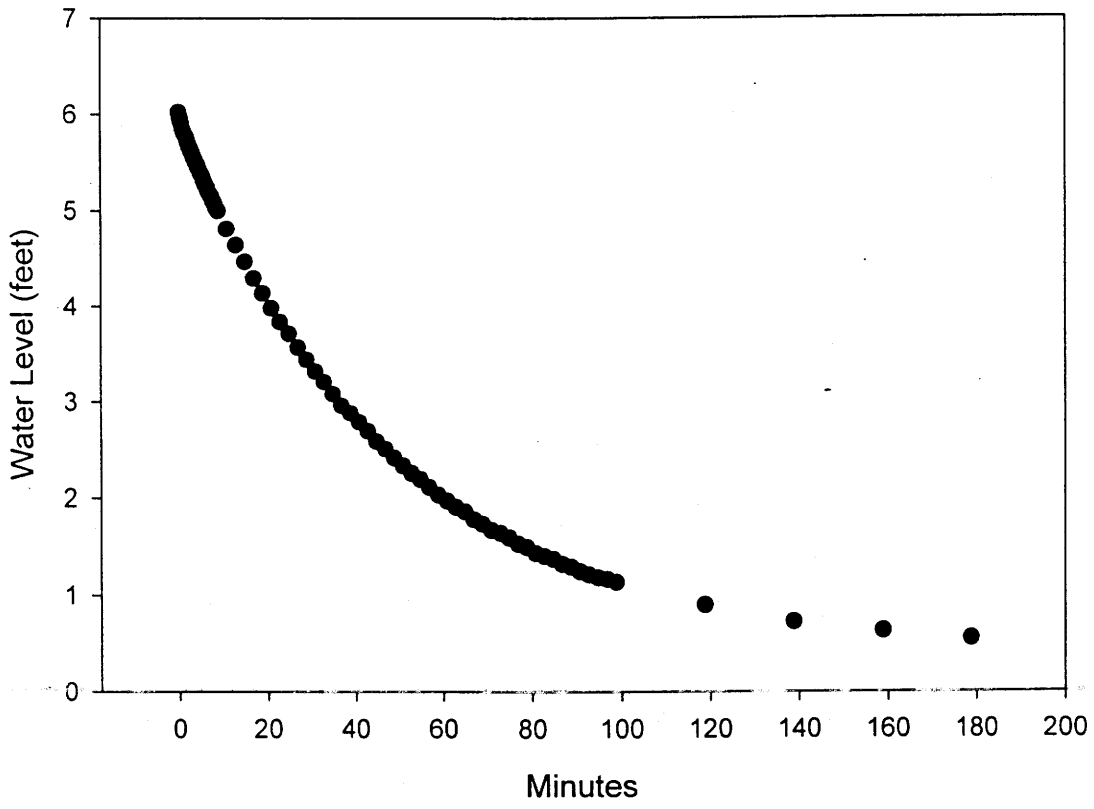
MW-7 Pressure Test

Time	Psi	Feet
00:00:00	0.0	0.00
00:00:30	11.5	26.57
00:01:00	12.0	27.72
00:01:30	12.7	29.34
00:02:00	13.0	30.03
00:02:30	13.5	31.19
00:03:00	13.8	31.88
00:03:30	14.0	32.34
00:04:00	14.0	32.34
00:04:30	14.3	33.03
00:05:00	14.5	33.50
00:05:30	14.8	34.19
00:06:00	14.9	34.42
00:06:30	15.0	34.65
00:07:00	15.2	35.11
00:07:30	15.3	35.34
00:08:00	15.4	35.57
00:08:30	15.5	35.81
00:09:00	15.6	36.04
00:09:30	15.8	36.50
00:10:00	15.9	36.73
00:10:30	15.9	36.73
00:11:00	16.0	36.96
00:11:30	16.0	36.96
00:12:30	16.2	37.42
00:13:30	16.4	37.88
00:14:30	16.5	38.12
00:15:30	16.7	38.58
00:16:30	16.8	38.81
00:17:30	16.9	39.04
00:18:30	17.0	39.27
00:19:30	17.1	39.50
00:21:30	17.5	40.43
00:23:30	17.7	40.89
00:25:30	17.9	41.35
00:27:30	18.1	41.81
00:29:30	18.2	42.04
02:35:30	21.5	49.67
03:08:30	22.0	50.82

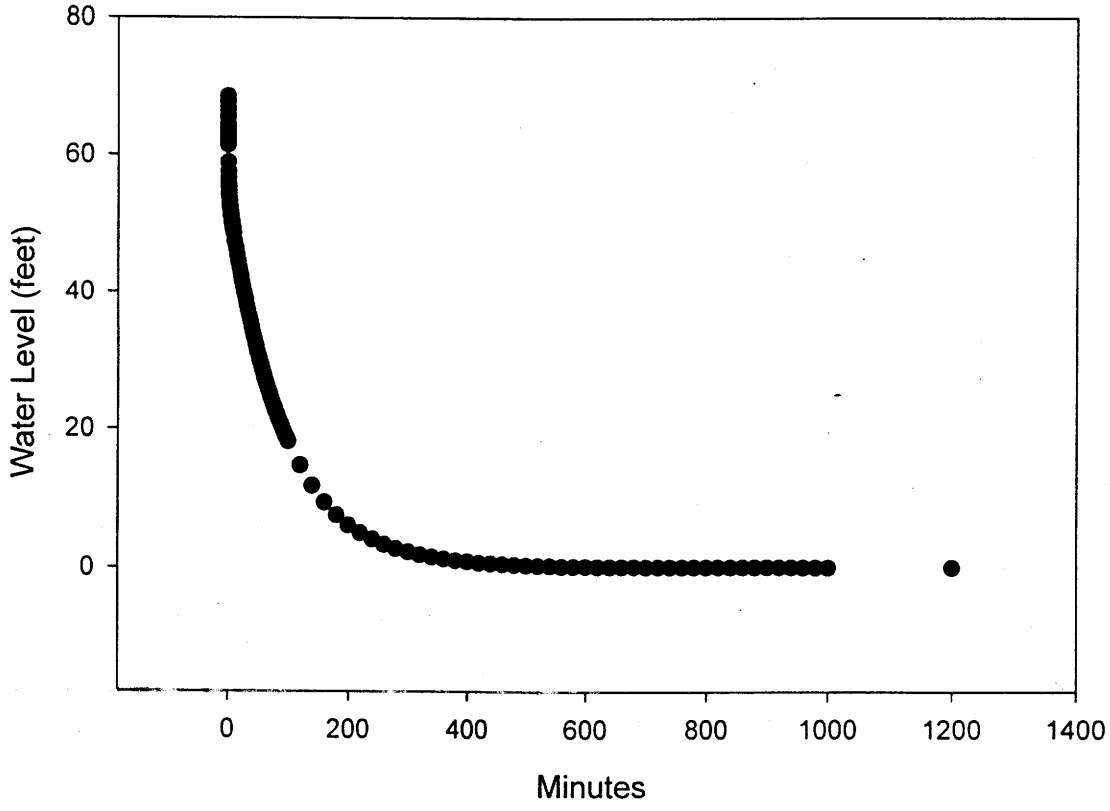
MW-2 slug test

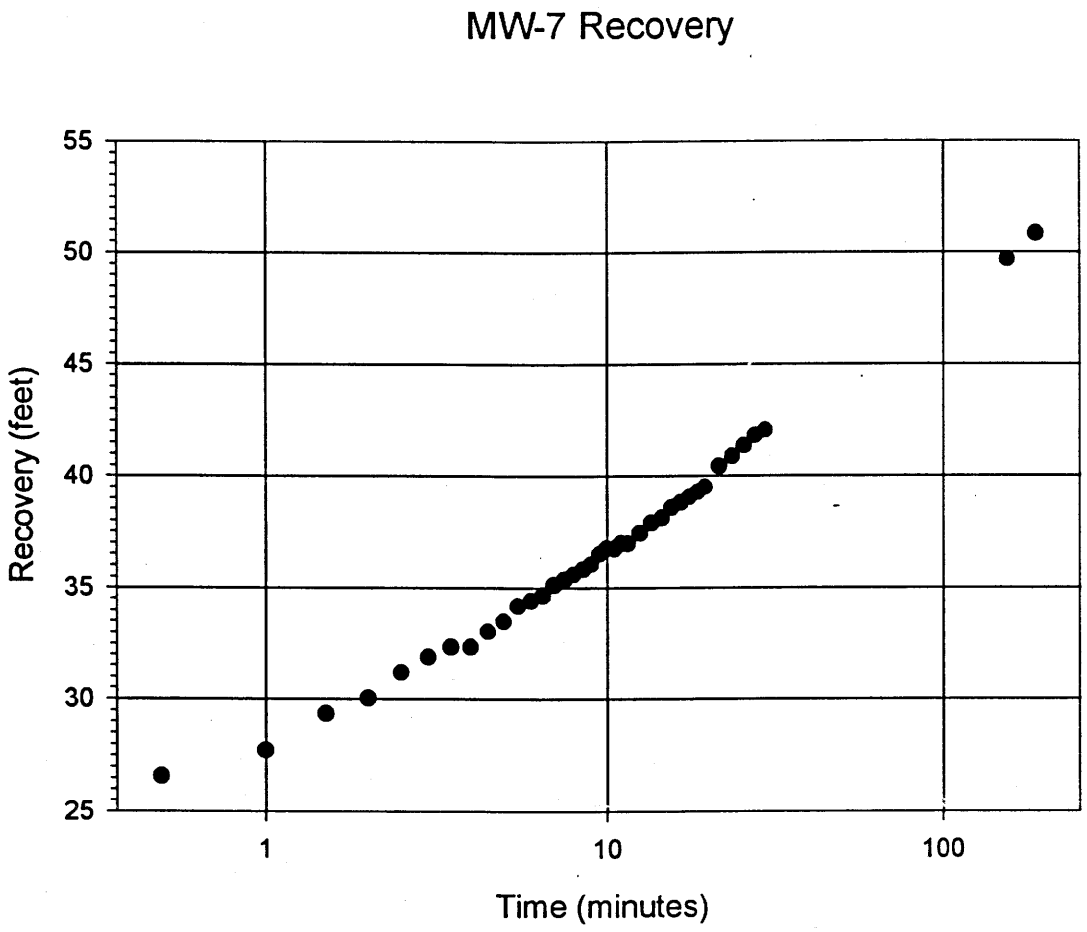


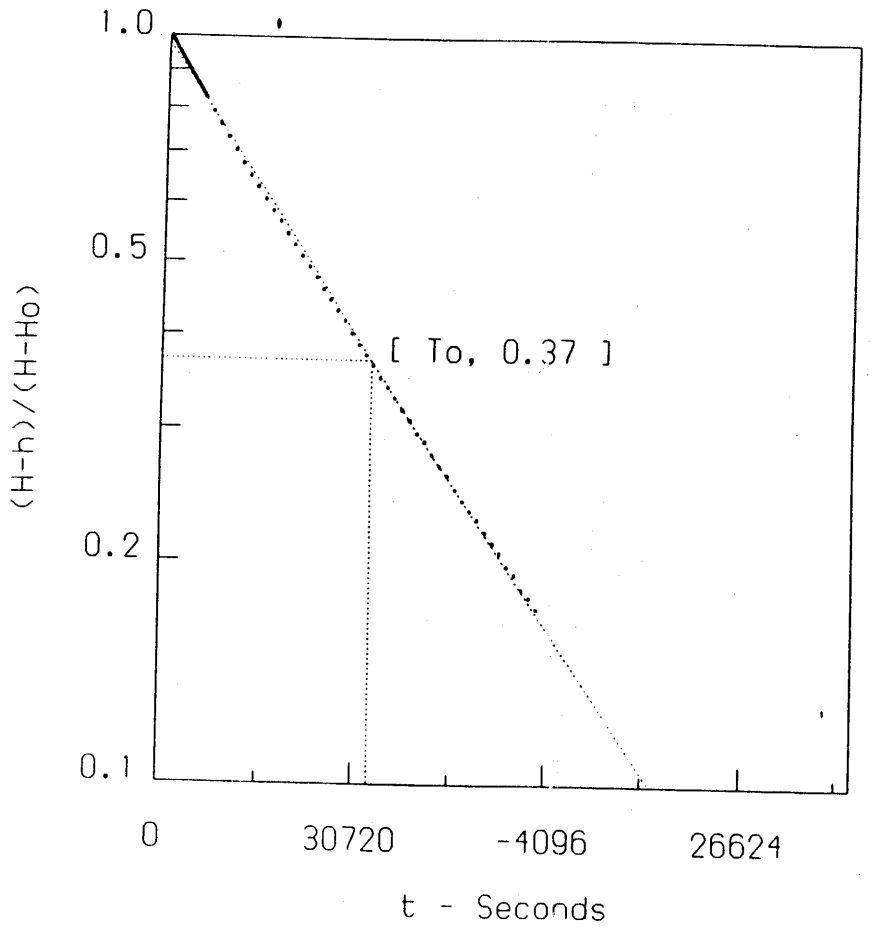
MW-6 slug test



MW-6A slug test




MW-7 Recovery
55
50
45
40
35
30
25
Recovery (feet)
1
10
100
Time (minutes)



Well I.D. = MW-2

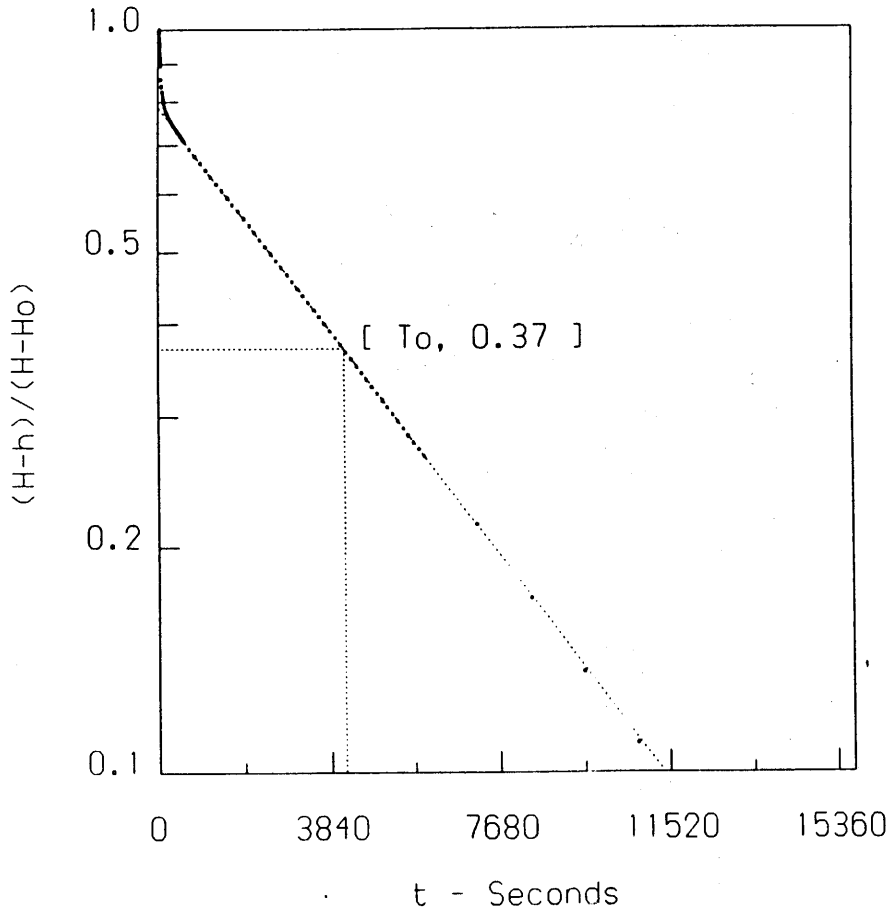
Well radius = 0.1667 ft

Intake radius = 0.1667 ft

Intake length = 50.0000 ft

To = 33342.45 sec.

K = 0.0000000475 ft/s



Well I.D. = MW-6a

Well radius = 0.0520 ft

Intake radius = 0.1250 ft

Intake length = 30.0000 ft

To = 4158.64 sec.

K = 0.0000000594 ft/s

WCI

WELL DRILLER'S REPORT
State of Utah
Division of Water Rights

For additional space, use "Additional Well Data Form" and attach

Well Identification MONITOR WELL: 97-93-001-M-01

Owner *Note any changes*
Genwal Resource Inc.
P.O. Box 1420
Huntington, UT 84528

Contact Person/Engineer: GARY GRAY / GENWAL RESOURCES

Well Location *Note any changes*
NORTH 400 feet WEST 300 feet from the SE Corner of
SECTION 2, TOWNSHIP 16S, RANGE 6E, SLB&M.

Location Description: (address, proximity to buildings, landmarks, ground elevation, local well #) MW -7

Drillers Activity Start Date: 3-13-97 Completion Date: 4-4-97

Check all that apply:
[X] New [ ] Repair [ ] Deepen [ ] Abandon [ ] Replace [ ] Public Nature of Use:

DEPTH (feet) FROM	TO	BOREHOLE DIAMETER (in)	DRILLING METHOD	DRILLING FLUID
0	100	3	FLUID ROTARY	WATER

Well Log

DEPTH (feet) FROM	TO	WATER	PERMEABLE high	PERMEABLE low	UNCONSOLIDATED CLAY	SILT	SAND	GRAVEL	COBBLES	BOULDER	OTHER	CONSOLIDATED ROCK TYPE	COLOR	DESCRIPTIONS AND REMARKS (include comments on *water quality* if known.)
0	100										X			SANDSTONE / CLAYSTONE

Static Water Level

Date 4-3-97 Water Level 0 feet Flowing? [X] Yes [ ] No
Method of Water Level Measurement WCI If Flowing, Capped Pressure 0.1 PSI
Point to Which Water Level Measurement was Referenced GROUND LEVEL
Height of Water Level reference point above ground surface 0 feet Temperature N/A [ ] °C [ ] °F

Construction Information

DEPTH (feet) FROM	DEPTH (feet) TO	CASING: CASING TYPE AND MATERIAL/GRADE	CASING: WALL THICK (in)	CASING: NOMINAL DIAM. (in)	DEPTH (feet) FROM	DEPTH (feet) TO	SCREEN ☒ PERFORATIONS ☐: SLOT SIZE OR PERF SIZE (in)	SCREEN DIAM. OR PERF LENGTH (in)	SCREEN TYPE OR NUMBER PER FT (per round/interval)
0	53	1 1/4" SCH 40 PVC		1 1/4	53	93	.010	1 1/4	

Well Head Configuration: FLUSH MOUNT Access Port Provided? ☒ Yes ☐ No

Casing Joint Type: FLUSH Perforator Used:

DEPTH (feet) FROM	DEPTH (feet) TO	FILTER PACK / GROUT / PACKER / ABANDONMENT MATERIAL: ANNULAR MATERIAL, ABANDONMENT MATERIAL and/or PACKER DESCRIPTION	Quantity of Material Used (if applicable)	GROUT DENSITY (lbs./gal.,# bag mix, gal./sack etc.)
0	1	CONCRETE	1	
1	40	CEMENT BENTONITE MIXTURE	2	
40	50	3/8" BENTONITE PELLETS	1	
50	100	16-40 SILICA SAND	2	

Well Development / Pump or Bail Tests

Date	Method	Yield	Units Check One: GPM	Units Check One: CFS	DRAWDOWN (ft)	TIME PUMPED (hrs & min)

Pump (Permanent)

Pump Description: Horsepower: Pump Intake Depth: feet

Approximate maximum pumping rate: Well disinfected upon completion? ☐ Yes ☐ No

Comments Description of construction activity, additional materials used, problems encountered, extraordinary circumstances, abandonment / procedures. *Use additional well data form for more space.*

Well Driller Statement

This well was drilled or abandoned under my supervision, according to applicable rules and regulations, and this report is complete and correct to the best of my knowledge and belief.

Name LAYNE CHRISTENSEN COMPANY License No. 626

(~~Person, Firm~~, or Corporation – Print or Type)

Signature (Licensed Well Driller) Date 4-10-97

WLI

WELL DRILLER'S REPORT
State of Utah
Division of Water Rights

For additional space, use "Additional Well Data Form" and attach

Well Identification MONITOR WELL: 97-93-001-M-02

Owner *Note any changes*
Genwal Resource Inc.
P.O. Box 1420
Huntington, UT 84528

Contact Person/Engineer: GARY GRAY / GENWAL RESOURCES

Well Location *Note any changes*
NORTH 200 feet EAST 400 feet from the SW Corner of SECTION 35, TOWNSHIP 15S, RANGE 6E, SLB&M.

Location Description: (address, proximity to buildings, landmarks, ground elevation, local well #) MW-8

Drillers Activity Start Date: 3-13-97 Completion Date: 4-4-97

Check all that apply:
[X] New [ ] Repair [ ] Deepen [ ] Abandon [ ] Replace [ ] Public Nature of Use:

DEPTH (feet) FROM	TO	BOREHOLE DIAMETER (in)	DRILLING METHOD	DRILLING FLUID
0	107	3	FLUID ROTARY	WATER

Well Log

DEPTH (feet) FROM	TO	WATER	PERMEABLE high	PERMEABLE low	UNCONSOLIDATED CLAY	SILT	SAND	GRAVEL	COBBLES	BOULDER	OTHER	CONSOLIDATED ROCK TYPE	COLOR	DESCRIPTIONS AND REMARKS (include comments on *water quality* if known.)
0	107										X			SANDSTONE / CLAYSTONE

Static Water Level

Date 3-31-97 Water Level 1.4 feet Flowing? [ ] Yes [ ] No
Method of Water Level Measurement WLI If Flowing, Capped Pressure NO PSI
Point to Which Water Level Measurement was Referenced GROUND LEVEL
Height of Water Level reference point above ground surface N/A feet Temperature N/A [ ] °C [ ] °F

Construction Information

DEPTH (feet) FROM	DEPTH (feet) TO	CASING: CASING TYPE AND MATERIAL/GRADE	CASING: WALL THICK (in)	CASING: NOMINAL DIAM. (in)	DEPTH (feet) FROM	DEPTH (feet) TO	SCREEN ☐ PERFORATIONS ☐: SLOT SIZE OR PERF SIZE (in)	SCREEN DIAM. OR PERF LENGTH (in)	SCREEN TYPE OR NUMBER PERF (per round/interval)
0	70	1 1/4"SCH 40 PVC		1 1/4	70	100	.010	1 1/4	

Well Head Configuration: FLUSH MOUNT Access Port Provided? ☒ Yes ☐ No

Casing Joint Type: FLUSH Perforator Used:

DEPTH (feet) FROM	DEPTH (feet) TO	FILTER PACK / GROUT / PACKER / ABANDONMENT MATERIAL: ANNULAR MATERIAL, ABANDONMENT MATERIAL and/or PACKER DESCRIPTION	Quantity of Material Used (if applicable)	GROUT DENSITY (lbs./gal., # bag mix, gal./sack etc.)
0	1	CONCRETE	1	
1	50	CEMENT BENTONITE GROUT	2	
50	55	3/8" BENTONITE PELLETS	1	
55	107	16-40	2	

Well Development / Pump or Bail Tests

Date	Method	Yield	Units Check One GPM	Units Check One CFS	DRAWDOWN (ft)	TIME PUMPED (hrs & min)

Pump (Permanent)

Pump Description: Horsepower: Pump Intake Depth: feet

Approximate maximum pumping rate: Well disinfected upon completion? ☐ Yes ☐ No

Comments

Description of construction activity, additional materials used, problems encountered, extraordinary circumstances, abandonment / procedures. *Use additional well data form for more space.*

Well Driller Statement

This well was drilled or abandoned under my supervision, according to applicable rules and regulations, and this report is complete and correct to the best of my knowledge and belief.

Name LAYNE CHRISTENSEN COMPANY License No. 626
(Person, Firm, or Corporation – Print or Type)

Signature Date 4-10-97
(Licensed Well Driller)

WL1

WELL DRILLER'S REPORT

State of Utah
Division of Water Rights

For additional space, use "Additional Well Data Form" and attach

Well Identification MONITOR WELL: 97-93-002-M-02

Owner *Note any changes*
Genwal Resources Inc.
P.O. Box 1420
Huntington, UT 84528

Contact Person/Engineer: GARY GRAY / GENWAL RESOURCES

Well Location *Note any changes*
NORTH 70 feet WEST 300 feet from the SE Corner of SECTION 2, TOWNSHIP 16S, RANGE 6E, SLB&M.

Location Description: (address, proximity to buildings, landmarks, ground elevation, local well #) MW-6A

Drillers Activity Start Date: 3-28-97 Completion Date: 4-4-97

Check all that apply:
[X] New [ ] Repair [ ] Deepen [ ] Abandon [ ] Replace [ ] Public Nature of Use:

DEPTH (feet) FROM	TO	BOREHOLE DIAMETER (in)	DRILLING METHOD	DRILLING FLUID
0	102	3	FLUID ROTARY	WATER

Well Log

DEPTH (feet) FROM	TO	WATER	PERMEABLES high	PERMEABLES low	UNCONSOLIDATED CLAY	SILT	SAND	GRAVEL	COBBLES	BOULDER	OTHER	CONSOLIDATED ROCK TYPE	COLOR	DESCRIPTIONS AND REMARKS (include comments on *water quality* if known.)
0	102										X			SANDSTONE / CLAYSTONE

Static Water Level

Date 3-28-97 Water Level 2.5 feet Flowing? [ ] Yes [X] No
Method of Water Level Measurement WL1 If Flowing, Capped Pressure NO PSI
Point to Which Water Level Measurement was Referenced GROUND LEVEL
Height of Water Level reference point above ground surface N/A feet Temperature N/A [ ] °C [ ] °F

Well Log

Construction Information

DEPTH (feet) FROM	DEPTH (feet) TO	CASING: CASING TYPE AND MATERIAL/GRADE	CASING: WALL THICK (in)	CASING: NOMINAL DIAM. (in)	DEPTH (feet) FROM	DEPTH (feet) TO	SCREEN ☒ PERFORATIONS ☐: SLOT SIZE OR PERF SIZE (in)	SCREEN DIAM. OR PERF LENGTH (in)	SCREEN TYPE OR NUMBER PERF (per round/interval)
0	72	1 1/4" SCH PVC		1 1/4	72	102	.010	1 1/4	

Well Head Configuration: FLUSH MOUNT Access Port Provided? ☒ Yes ☐ No

Casing Joint Type: FLUSH Perforator Used:

DEPTH (feet) FROM	DEPTH (feet) TO	FILTER PACK / GROUT / PACKER / ABANDONMENT MATERIAL: ANNULAR MATERIAL, ABANDONMENT MATERIAL and/or PACKER DESCRIPTION	Quantity of Material Used (if applicable)	GROUT DENSITY (lbs./gal..# bag mix, gal./sack etc.)
0	1	CONCRETE	1	
1	70	CEMENT	4	
70	72	3/8 BENTONITE PELLETS	1	
72	102	16-40 SILICA SAND	2	

Well Development / Pump or Bail Tests

Date	Method	Yield	Units Check One GPM	Units Check One CFS	DRAWDOWN (ft)	TIME PUMPED (hrs & min)

Pump (Permanent)

Pump Description: Horsepower: Pump Intake Depth: feet

Approximate maximum pumping rate: Well disinfected upon completion? ☐ Yes ☐ No

Comments Description of construction activity, additional materials used, problems encountered, extraordinary circumstances, abandonment / procedures. *Use additional well data form for more space.*

Well Driller Statement

This well was drilled or abandoned under my supervision, according to applicable rules and regulations, and this report is complete and correct to the best of my knowledge and belief.

Name LAYNE CHRISTENSEN COMPANY License No. 626
(Person, Firm, or Corporation – Print or Type)

Signature
(Licensed Well Driller)

Date 4-10-97

P.O. Box 1420
Huntington, UT 84528

Contact Person/Engineer: GARY GRAY / GENWAL RESOURCES

Well Location *Note any changes*

NORTH ~~620~~ 640 feet WEST ~~290~~ 300 feet from the SE Corner of SECTION 2, TOWNSHIP 16S, RANGE 6E, SLB&M.

Location Description: (address, proximity to buildings, landmarks, ground elevation, local well #) MW-6

Drillers Activity Start Date: 3-28-97 Completion Date: 4-4-97

Check all that apply:

[X] New [ ] Repair [ ] Deepen [ ] Abandon [ ] Replace [ ] Public Nature of Use:

DEPTH (feet) FROM	TO	BOREHOLE DIAMETER (in)	DRILLING METHOD	DRILLING FLUID
0	350	3	FLUID ROTARY	WATER

Well Log

DEPTH (feet) FROM	TO	WATER	PERMEABLE high	PERMEABLE low	UNCONSOLIDATED CLAY	SILT	SAND	GRAVEL	COBBLES	BOULDER	OTHER	CONSOLIDATED ROCK TYPE	COLOR	DESCRIPTIONS AND REMARKS (include comments on *water quality* if known.)
0	350										X			SANDSTONE/CLAYSTONE

Static Water Level

Date 3-28-97 Water Level 2.5 feet Flowing? [ ] Yes [X] No

Method of Water Level Measurement WL1 If Flowing, Capped Pressure NO PSI

Point to Which Water Level Measurement was Referenced GROUND LEVEL

Height of Water Level reference point above ground surface N/A feet Temperature N/A [ ] °C [ ] °F

Well Log

97.2 / 11

Note: Water level @ 7:15 A 3/13/9
2.35' bgl

C - 1857 (8/79)

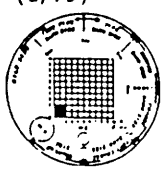
TYPE	DESCRIPTION
CUTTINGS	
CORE	X
OUTCROP	

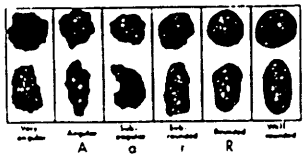
Andalex Resources, Inc.

HOLE NO. MW-4
PAGE 2 OF 4
Geologist R. Hall

BOX NO.	SMPL. NO.	DEPTH FROM	DEPTH TO	THICKNESS	STRIP LOG 1" =	MEDIAN GRAIN SIZE V F S M C VC	ROUNDNESS A SR R	SORTING P M W	DESCRIPTION & REMARKS
11 107.0	55 Fract. Bedding				100				Sandstone, lt to med. gray, fine to very fine, SaP, Quartz grains are dominate
12 116.7	10 Horiz. Fract. Bedding								Clast, Calcareous, v. minor Carbonaceou laminae.
13 126.6	8 Horiz. Fract. Bedding			123.8	110				@ 103 SS as above with carb laminae increasing slightly.
		123.8	129.2	5.4'					@ 110.5' Sandstone as ab with interb of clayey siltstone, dark gray, calcareou
14 136.5	3 Horiz. Fract. Bedding		Storrs		120				cross laminated.
15 146.5	0 Fractures Bedding								@ 111.15 SS as ab.
16 155.7	0 Fractures Bedding				130				@ 118.45 SS as ab with siltstone as
17 166.6	1 Fracture								@ 114.1 SS as above.
18 175.4	2 Fractures Bedding				140				@ 117.5' Sandstone and interbeds of silt as ab. Carbonate increased to highly ca Clay fraction inc. with depth
19 185.2	4 Fractures Bedding								@ 123.8' Sandstone, brown black, fine gra Carbonaceous, noncalcareous, quartz cla
20 194.6	5 Fractures Bedding				150				are sub to well rounded, frosted to clear.
21									@ 129.2' Sandstone, lt brown gray to tan, med. to fine grained, noncalc, quartz clast sub to well rounded, frosted to clear, some
					160				Note: Hole Purged at 130.6' - water level ros 2.5' in 4 minutes. = .78 gpm 0.17
									Sandstone becoming lighter gray with c and grain size increasing. White Feldsp Common, bkp
					170				Sandstone as above fine to med. gray becoming slightly calcareous, very
									uniform, very little carb. material, mo bedding.
					180				Sandstone as ab, clean, uniform, massi
									@ 160' Sandstone, lt gray, fine grained, Sa uniform, massive, calcareous.
					190				@ 174.8 SS as ab with Claystone laminae, dark grey to black, ap noncalcareous.
									@ 175.4 Sandstone as above, Clay fraction decreased to 0%, SS is uniform, massive.
					200				@ 182. and 183 Sandstone as ab w silty Claystone interbeds to laminae, d gray to black. Bedding planes occur c zones of high clay content.
									@ 187.85 Interbedded Claystone, dark to black and Sandstone as above.
									Note: Hole Purged @ 5:00 pm 3/13/97 @ 7:1 on 3/14/97 Water level at 2.5' bgl
									@ 196.5' Claystone fraction inc. Claystone is dark gray to black, calc. to calc., carbonaceous.

C - 1857 (8/79)





PAGE ____ OF ____

HOLE NO. MW

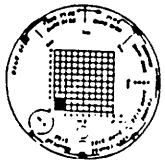
TYPE OF DESCRIPTION

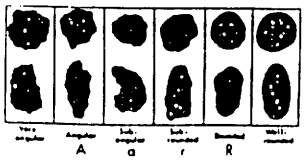
CUTTINGS	
CORE	X
OUTCROP	

Andalex Resources, Inc.

HOLE NO. MW-6
PAGE 3 OF 4
Geologist R. Hollan

BOX NO.	SMPL. NO.	DEPTH FROM	DEPTH TO	THICKNESS	STRIP LOG	MEDIAN GRAIN SIZE	ROUNDNESS	SORTING	DESCRIPTION & REMARKS
21 204.4	7 Fract. Bedd.								@ 201.1 sandstone, lt gray, vfg to fg, slightly calcareous, well indurated, quartz clast are sub to well rounded, frosted to clear, minor sap
22 214.4	6 Fract. Bedding								Note: at 205.7' .49 gpm flow. @ 205' sandstone as ab with some clay laminae - zones of turbation.
23 224.2	11 Fract. Bedd. 1 vertical Fract.								@ 216 well developed cross laminae. Clay fraction inc. with depth. Beddin Fractures occure prim. along clay laminae. Coal laminae at 217.5' @ 222.7' verticle fracture, Pyrite common along fracture face.
24 234.0	6 Fract - Bedd. 3 Fract. - Vert.								@ 226 verticle fracture with Pyrite Sandstone, lt gray, vfg, calc, clayey laminae common but dec. with depth. @ 227' sandstone, med to dark gray, vfg, clayey laminae and turbation zones, calcareous. worm burrows(?) noted.
25 243.8	8 Fract-Bedd 3 Fract. - Vert.								Note: since encountering the vertical Fract. the drilling fluid returns have decreased @ 231.5 core becoming darker gray with increase in clay fraction. verticle fracture @ 231 to 235.5'
26 253.4	6 Fract. - Bedd.								@ 236.5' hole making 4.22 gpm. @ 238 verticle fracture with abundan pyrite along fracture face. Core displays bioturbation and clay laminae. Circulation becoming a problem - lost into
27 263.3	2 Fract. - Bedd 1 Fract - Vert.								@ 242.2 ss, lt gray, vfg to fg, slightly to calcareous, well indurated, massive, minor clay laminae. @ 246 Artesian flow @ 1.0 gpm @ 244.5 + 251.7 dark gray round spots.
28 278.15	4 Fract. - Bedd 1 Fract. - Vert.								@ 260' verticle fracture with pyrite some cross laminae and claystone inclusions.
		267.2	269.4	2.2					@ 265.5' pinkish calcite inclusion 1" long @ 267' Hydrolic head at 1.9' bgl 3/15/97
29 282.9	0 Fractures	269.4	284.9	15.5'					@ 267.2 ss, lt to dark gray, vf to fg, strong bioturbated, slightly calcareous, base is cross laminated, clayey. @ 269.4 sandstone, lt gray, vfg, slight. Calc., sap, uniform. @ 275 ss as above becoming darker gray and fine grained. @ 284.9' sandstone as ab with Claystone bands
30 292.5	9 Fract. - Bedd	284.9	292.0	7.1					and inclusions, Claystone is dark gray to blk, non to slightly calcareous. - most of the inclusions are prob. clean clast. @ 290.5 - 291.7 rounded brown inclusi up to 2" diameter - ss.
		292.0	315.3	23.3					@ 292.0' Sandstone, med gray, fine grained, calc. with abundant clay laminae, carbonaceous. @ 297.2 Sandstone as ab with interbeds of siltstone, clayey, blk, slightly calc. and clays. blk, slightly calc.





TYPE DESCRIPTION	
CUTTINGS	
CORE	X
OUTCROP	

HOLE NO. MW-
PAGE 4 OF 4
Geologist R. Hol

BOX NO.	SMPL. NO.	DEPTH FROM	DEPTH TO	THICKNESS	STRIP LOG
31 (303.4)	11 Fract. Bedd				300
32 (311.15)	6 Fract.-Bedding				310
33 (321.0)	10 Fract.-Bedding	315.3	357.0 (Panther)	35.7	320
34 (330.9)	5 Fract.-Bedding				330
35 (340.7)	7 Fract.-Bedding				340
36 (351.0)	6 Fract.-Bedd, 1 Verticle				350
			TD 351.0		

DESCRIPTION & REMARKS

at 301.8 - 302.2 claystone with interbedded SS

@ 307.3' Sandstone, lt to med. gray, vfg t
fg, slightly calc., low angle cross beddi

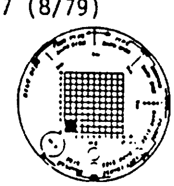
Calcite inclusions <1" at 310.5'
308.8 - 311.75 SS as above with min
interbeds of claystone, dark gray to blk.
@ 311.75' Purged hole with core barrel —
Recharge measured at 1.4 gpm. Blow
with air compressor for 1.25 hr - hole made 2.5
@ 312.7 Claystone interbed, blk, silty,
calc, to slightly calc. Clay interbeds incr
to 313.8. @ 313.8 sandstone, med t
dark gray, cross laminae, coal at 31
to 315.3.
@ 315.3' Sandstone, lt to med gray, fine
slightly calc, sd P, becoming very uniform wi
depth, minor clay laminae.
@ 321.5 SS as ab, cross bedded, fine t
medium grained
@ 338.8 claystone parting <1"
Sandstone as above, cross bedding

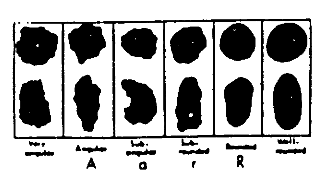
@ 344.7 - 345.0 SS as ab with claysto
interbeds exhibiting bioturbation.

@ 347.3 Interbedded claystone, siltst
and vfg sandstone, med gray to da
gray to black, calcareous, bioturb
common.
at 350.7' vfg to silty sandstone, da
gray to black when wet.
Note: From 347.3 To 351.0 will
most likely act as impervious to
downward migration of water.
Purged hole: water level rose 10.
in 25 sec. = 9.6 gpm.

Roger F Holland
3/15/97

C - 1857 (8/79)





Construction Information

DEPTH (feet) FROM	DEPTH (feet) TO	CASING: CASING TYPE AND MATERIAL/GRADE	CASING: WALL THICK (in)	CASING: NOMINAL DIAM. (in)	DEPTH (feet) FROM	DEPTH (feet) TO	SCREEN ☒ PERFORATIONS ☐: SLOT SIZE OR PERF SIZE (in)	SCREEN DIAM OR PERF LENGTH (in)	SCREEN TYPE OR NUMBER PERF (per round/interval)
0	305	1 1/4" SCH 40 PVC		1 1/4	305	345	.010	1 1/4	
345	350	1 1/4" SCH 40 PVC		1 1/4					

Well Head Configuration: FLUSH MOUNT Access Port Provided? ☒ Yes ☐ No

Casing Joint Type: FLUSH Perforator Used:

DEPTH (feet) FROM	DEPTH (feet) TO	FILTER PACK / GROUT / PACKER / ABANDONMENT MATERIAL: ANNULAR MATERIAL, ABANDONMENT MATERIAL and/or PACKER DESCRIPTION	Quantity of Material Used (if applicable)	GROUT DENSITY (lbs./gal.,# bag mix, gal./sack etc.)
0	1	CONCRETE	1	
1	290	CEMENT BENTONITE GROUT	14	
290	300	BENTONITE SLURRY	1	
300	350	16-40 SILICA SAND	3.5	

Well Development / Pump or Bail Tests

Date	Method	Yield	Units Check One GPM	Units Check One CFS	DRAWDOWN (ft)	TIME PUMPED (hrs & min)

Pump (Permanent)

Pump Description: Horsepower: Pump Intake Depth: feet

Approximate maximum pumping rate: Well disinfected upon completion? ☐ Yes ☐ No

Comments Description of construction activity, additional materials used, problems encountered, extraordinary circumstances, abandonment / procedures. *Use additional well data form for more space.*

Well Driller Statement This well was drilled or abandoned under my supervision, according to applicable rules and regulations, and this report is complete and correct to the best of my knowledge and belief.

Name LAYNE CHRISTENSEN COMPANY License No. 626
(Person, Firm, or Corporation – Print or Type)

Signature (Licensed Well Driller) Date 4-10-97